

## HCM 14 Laboratory Trainer Lab

Fault and Diagnostics Trainer Lab with HCM 14 operational half car, operating client's car or PT CM 14 motor trainer



### OBJECTIVE

To offer a hands-on training in conjunction to a real operational 1:1 scale car model or operating engine with built-in Fault ECU simulator and Diagnostic tools for complete Automotive and Autoelectrical maintenance and service training.

**Note:** HCM line of products is based on operational cars, the HCM 14 **an operational** half car or can also be provided with just operating motor trainer such as **PT CM14** (new or refurbished).

### GENERAL DESCRIPTION

The HCM 14 lab standard configuration is based on certain types of engines i.e. VW POLO 1.4cc engine with a 5 gear manual gearbox or the SKODA Fabia 14i, Seta Ibiza 14 s etc.

It can be customized for any other type of vehicle or automotive motor trainer with ECU (operating stand alone motor assembly) which the buyer will require, subjected to modifications required.

The HCM 14 lab comes with a mobile cart where the **HCM 14 CB - Control Board** is installed. It is a bench-top console, based and fitted on a movable cart (with storage selves for the auxiliary equipment in a cabinet space to store and a lock for safe keeping of the equipment).

The cart is also provided with a display screen with movable arm in order for the teacher to display Diagnostic information needed by the students for each experiment. The display is connected to the electronic tablet of the teacher.

The HCM 14 CB - Control Board on the console is easily integrated and disconnected from the car via the provided 155 pin cabling.

### OPERATIONAL PARAMETERS

The car's engine is connected via cabling with **HCM 14 CB**. This allows a range of open circuit and high resistance faults to be inserted by the instructor to the ECU unit and the students must diagnose. A variety of these faults can be inserted and a systematic maintenance service procedure is followed in order to diagnose and troubleshoot the problems.

The HCM 14 CB is specifically designed to aid teaching diagnostics, fault finding and troubleshooting.

### HCM 14 CB - CONTROL BOARD

The Control Board is integrated to the HCM cart console. During laboratory operation

the HCM 14 CB is connected to the car's ECU. It includes minimum **155 Error Switches** which assist to simulate all possible faults that the ECU can produce from the teacher console. The console includes the following components:

1. Potentiometers: 10 / 50 / 100 kΩ with 2 Watt regulated resistance
2. In/output connectors: connection of the HCM14CB between the wiring harness and the engine computer by using the correct adapter cable based on the type of the car engine used.
3. 155 terminals in Black contact bus (1-155): connection with wiring harness / engine
4. 155 terminals Red contact bus (1-155): connection with the engine computer
5. 155 On/Off switches (1-155): switch to interrupt the ECU circuits
6. Switch pulse generator: switch for various pulse generator output signals
7. Red led 12 Volts (2x)
8. Pin number ECU-connector
9. Anodized alum Front plate (electrically isolated)

Connection between the test engine ECU and the Console of the trainer is provided by using the appropriate provided cabling. The console of the trainer can be connected in different types of operational motors. During the exercises, the teacher can simulate various engine faults which students must diagnose.

They can also use the terminal of the HCM 14 board in order to take signal measurements based on the nominal and faulty value detection. The electrical wiring provides fuse protections for all possible connections. The console cabling can be easily integrated and disconnected from ECU. It has length greater than 1,5m in order for the console to have enough distance from the operating car or engine. The HCM 14 CB is connected via a Pin-Box with 4mm -terminals and cables- and the appropriate connectors having direct access to the pins, required for the lessons, on the engine control unit ECU.

Diagnostic sockets are fitted to the engine rigs as appropriate. The Control Board is pre-wired and installed. Includes on/off switches and potentiometers for different tests.

Schematics and fault directions are supplied for detailed understanding of the diagnosis and troubleshooting process. The

engine rigs offer an enhanced training resource, hands-on training with real components, as 1:1 scale operational engine.

The instructor can make up his own fault simulation very easily, using the HCM 14 CB and inserting various other faults he wants to instruct his students on.

It offers to the student the real time training without the constraints of a simulator or modular systems, by offering **one-car-system at site**.

The HCM 14 CB can simulate **systematic car faults**. Depending on the ECU pin-out, the HCM 14 CB is possible to simulate all faults associated with each pin of the ECU. In HCM 14 laboratory there are simulated fault instructions using the **Error Switches which assist to simulate faults**, as for example:

1. Open circuit mass of the accelerator pedal position (APP) sensor.
  2. Open circuit mass of the clutch pedal position (CPP) switch.
  3. Open circuit mass of the heated oxygen sensor (HO2S) 1.
  4. Open circuit mass of the heated oxygen sensor (HO2S) 2.
  5. Open circuit mass of the brake pedal position (BPP) switch.
  6. Open circuit mass of the evaporative emission (EVAP) canister purge valve.
  7. Open circuit mass of the fuel pump (FP) relay.
  8. Open circuit mass of the throttle position sensor.
  9. Open circuit mass of the throttle motor.
  10. Open circuit mass of the intake air temperature (IAT) sensor.
  11. Open circuit mass of the camshaft position (CMP) sensor.
  12. Open circuit mass of the crankshaft position (CKP) sensor.
  13. Open circuit mass of the injectors each cylinder.
  14. Open circuit mass of the engine coolant temperature (ECT) sensor.
  15. Open circuit mass of the ignitions amplifier each cylinder.
  16. Open circuit mass of the manifold absolute pressure (MAP) sensor.
  17. Open circuit mass of knock sensor (KS).
  18. Open circuit mass of the exhaust gas recirculation (EGR) valve position sensor.
  19. Open circuit mass of the exhaust gas recirculation (EGR) valve actuator.
  20. Open circuit mass of alternator.
- More than 20 faults are created.

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### ADDITIONALLY

#### \* HCM 14 CTTT Diagnostic electronic hand held Tablet

The HCM 14 comes with a Diagnostic electronic hand held terminal, to be used by the students with a wireless OBD II connector on the 16-pin outlet of the ECU after the instructor inserts faults. By using the diagnostic protocol, it allows the user to access almost all the engine systems. It is small, robust, affordable and easy to use. The terminal is connected to the OBD engine connector via Wi-Fi network. The display of the terminal is connected to the wide screen set of the HCM 14 CB and operates so students can see the different indices and virtual instruments readings while they are doing the fault finding and maintenance procedure.

#### Features

- Reads and erases Diagnostic Trouble Codes (DTCs) of almost all the systems.
- Turns off MILs of engine, airbag, ABS, A/T and most other systems.
- Resets Oil Service Light, service mileage and service intervals.
- Replaces and recalibrates brake pads safely.
- Supports ALL 10 test modes of the latest OBD test specs including: Read Codes, Erase Codes, Live Data, Freeze Frame, I/M Readiness, O<sub>2</sub> Mon. Test, On-Board Mon. Test, Component Test and Vehicle Information.
- Data graphing.
- Troubleshooter codes tips the user to the root cause of trouble code faster, saving diagnosis time.
- Can print data via
- Runs on multiple student tablets (Android or MS Windows 8 or higher).

#### Specifications

- Display: TFT color display (320 x 240 dpi)
- Operating Temperature: 0°C to 60°C (32°C to 140 °F)
- Storage Temperature: -20°C to 70°C (-4°C to 158 °F)
- External Power: 12.0 to 18.0 V power provided via vehicle battery
- Dimensions (LxWxH): 199x104.5x37.5mm
- Weight: 0.28kg(without wire),0.484kg (with wire)

The system can be offered using also PT-MEM 4000, as a more high-end diagnostic device.

#### \* HCM 14 Oscilloscope & Multimeter - (OPTIONAL)

The HCM 14 comes with a hand-held Oscilloscope terminal and a Multimeter to be used by the students to make measurements with these instruments in various diagnostic process where they are needed and according to instructions.

#### Specifications

- Bandwidth: up to 10 MHz (-3dB or -4dB at selected ranges)
- Input range: 1mV to 20V/division in 14 steps
- Input coupling: DC, AC and GND
- Real-time sample rate up to 40MS/s
- AD resolution: 8 bits
- Time base: 250ns to 1h per division
- Auto set-up function (or manual)
- Probe x10 readout option
- Readouts: DC, AC & DC, True RMS, dBm, Vpp, Min-Max. ( $\pm 2.5\%$ )
- Audio power measurement from 2 to 32 ohms
- Hold & store function
- Time and Voltage markers readout
- Max. 100Vp AC+DC
- White LED backlight
- Operates on NiMH rechargeable battery pack (included)
- Operates up to 6 hours on one charge (it is not recommended to use the device while using the USB charger-otherwise, the user should use a standard 9VDC mains adaptor)
- Charging power supply: 9Vdc/200mA
- Dimensions: 74 x 114 x 29mm
- Extra Features: Audio Power measurement

#### Features

- 40 Mega samples/sec in real time.
- Full auto range option.
- Sensitivity down to 0.1mV.
- Signal markers for amplitude and time.
- Memory hold function.
- USB battery charger included.

#### \* Digital Multimeter Specifications

- DC Voltage: Range: 200mV-1000V, Accuracy: $\pm(0.5\%+1\text{dgt})$
- AC Voltage: Range:20V-750V,Accuracy:  $\pm(0.8\%+3\text{dgt})$
- DC Current: Range: 20mA-20A, Accuracy: $\pm(0.8\%+1\text{dgt})$
- AC Current: Range:200mA-20A, Accuracy:  $\pm(1.8\%+3\text{dgt})$
- Resistance: Range:200 $\Omega$ -200M $\Omega$ , Accuracy: $\pm(0.8\%+1\text{dgt})$
- Capacitance: Range:2nF-20 $\mu$ F, Accuracy:  $\pm(2.5\%+3\text{dgt})$
- Frequency: Range:2KHz-20KHz, Accuracy:  $\pm(1.5\%+5\text{dgt})$
- Temperature: Range:-40°C~1000°C, Accuracy: $\pm(0.75\%+3\text{dgt})$
- It includes : Diode Test, Transistor Test, Continuity Buzzer, Auto Power Off Data Hold, Logic Test, Power Supply 9V Battery, Display: 1999 pix.

#### The HCM 14 can connect to vehicles with the following engine specifications in its standard configuration:

Type	4 cylinder inline
Displacement	1398 cc
Fuel Type	Petrol
Max Power	75 bhp
Max Power @ RPM	5400 RPM
Max Torque	110 Nm
Max Torque @ RPM	3750 RPM
Mileage (ARAI)	16.47 kmpl
No of Cylinders	4 Cylinders
Cylinder Configuration	Inline
Valves per Cylinder	4 Valves
Transmission Type	Manual
No of gears	5 Gears
Drivetrain	FORWARD

In case client has already another type of operating engine, HCM 14 CB can be adapted, subjected to certain alterations and customization.

#### Required Additional Devices

The HCM 14 is accompanied also by the PT-HCM 100 Professional Diagnostic set. It is an integral part of the HCM 14 curriculum. Please read the PT-HCM 100 specifications in the following pages.